

18. ⁴⁹ A method of manufacturing a semiconductor device according to any one of claims ⁵, and ~~36-48~~, wherein said step of leveling said surface of said semiconductor film is conducted by furnace annealing.

19. ⁵⁰ A method of manufacturing a semiconductor device according to any one of claims ⁵, and ~~36-48~~, wherein said step of leveling said surface of said semiconductor film is conducted between 900 and 1200 °C.

20. ⁵¹ A method of manufacturing a semiconductor device according to any one of claims ³⁷, ~~40, 42~~, and ¹² ~~46~~, wherein said inert gas is nitrogen.

21. ⁵² A method of manufacturing a semiconductor device according to any one of claims ^{36, 39, 42}, and ¹¹ ~~48~~, wherein said reducing atmosphere comprises hydrogen.

22. ⁵³ A method of manufacturing a semiconductor device according to any one of claims ⁵, and ~~36-48~~, further comprising a step of treating a surface of said semiconductor film with a buffered hydrofluoric acid before said irradiation of said laser light.

23. ⁵⁴ A method of manufacturing a semiconductor device according to any one of claims ⁵, and ~~36-48~~, wherein said semiconductor device is one selected from the group consisting of a personal computer, a video camera, a goggle-type display, a digital camera, and a projector.--

REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the present application.

The Examiner's Office Action dated April 23, 2001, has been received and its contents reviewed. By this Amendment claims 6-35 have been canceled, claim 5 has been amended, and new claims 36-54 have been added. Claims 5 and 36-54 are now pending in the present application, of which claims 5, and 36-48 are independent.

Referring now to the Office Action, claims 5, 6, 8-10, 12, 14-17, and 19-22 are rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Takemura (U.S. Patent No. 5,616,506) in view of Zhang et al. (U.S. Patent No. 5,569,610). Claims 7, 11, 13 and 18 are rejected as allegedly unpatentable over Takemura in view of Zhang et al. (U.S. Patent No. 5,569,610) as applied to claims 5, 6, 8-10, 12, 14-17, and 19-22 and further in view of Zhang et al. (U.S. Patent No. 5,888,857). Claim 23 was rejected as allegedly unpatentable over Takemura in view of Zhang et al. (U.S. Patent No. 5,569,610), Zhang '857 and Dorin et al. Claims 24-31 are rejected as allegedly unpatentable over Takemura, Zhang '857, Zhang et al. (U.S. Patent No. 5,569,610) and Dorin as applied to claims 5-23, and further in view of Sameshima et al. (U.S. Patent No. 5,910,015). Claims 32-35 are rejected as allegedly unpatentable over Takemura and Zhang et al. (U.S. Patent No. 5,569,610) as applied to claims 19 and 21 and further in view of Yamazaki et al. (U.S. Patent No. 6,093,937).

Applicants have canceled claims 6-35. Accordingly, the § 103 rejections of claims 6-35 are now moot.

Claim 5 has been amended as shown above to recite a method of manufacturing a semiconductor device comprising the steps of:

- a first step forming a semiconductor film comprising silicon over a substrate;
- a second step of providing the semiconductor film with a catalytic element for facilitating a crystallization of said semiconductor film;
- a third step of irradiating the semiconductor film with laser light in air for crystallizing the semiconductor film after providing the catalytic element;
- a fourth step of removing an oxide film from a surface of the semiconductor film by etching after the irradiation of the laser light; and
- a fifth step of leveling the surface of the semiconductor film by heating after removing the oxide film.

Support for the third step can be found in, e.g., page 7, lines 19-21 of the specification; support for the fourth step can be found in, e.g., page 8, lines 1-3 of the specification; and, support for the fifth step can be found in, e.g., page 16, lines 12-14 of the specification.

Applicants respectfully submit that none of the cited prior art references disclose or suggest the claimed third to fifth steps.

Further, as mentioned in the last paragraph of page 5 of the specification, when a laser light is irradiated to the semiconductor film, asperities (ridges) are produced on the surface of the semiconductor film, which greatly affects TFT characteristics as described. However, the claimed invention as recited in claim 5 is very effective in flattening the surface of the semiconductor film.

With respect to new claims 36-54, claims 41-46, and 48 recite to treat a surface of the semiconductor film with a hydrofluoric acid after the irradiation of the laser light. Support for new claims 41-46, and 48 can be found at least from the last row of page 7 to page 8, line 1, for example.

Claims 36, 39, 42 and 45 recite to level the surface of the semiconductor film by heating in an inert gas. Support for new claims 36, 39, 42, and 45 can be found at least from page 15, last second row to page 16, line 1, for example.

Claims 38-40 and 44-48 recite a concentration of oxygen or an oxygen compound contained in the leveling step atmosphere is 10 ppm or less. Support for new claims 38-40 and 44-48 can be found at least on page 16, lines 6-10, for example.

Applicants respectfully submit that amended claim 5, as well as new claims 36-54, includes the third step to the fifth step as described above, and the pending claims 5, and 36-54 are distinguished from the cited references as the cited prior art references are deficient in suggesting or disclosing the claimed steps.

In view of the foregoing amendments and arguments, Applicants respectfully request reconsideration and withdrawal of the U.S.C. § 103(a) rejections of claims 5-35.

CONCLUSION

Having responded to all rejections set forth in the outstanding non-Final Office Action, it is submitted that claims 5 and 36-54 are now in condition for allowance. An early and favorable Notice of Allowance is respectfully solicited. In the event that the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or

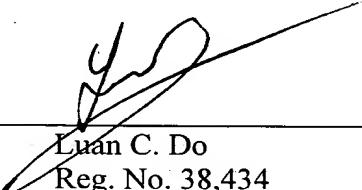
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more of the above claims, the Examiner is courteously requested to contact Applicants' undersigned representative.

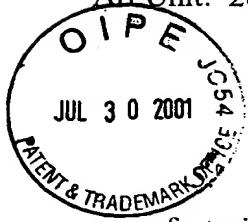
Respectfully submitted,

By _____


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VERSION OF AMENDED CLAIM WITH
MARKINGS TO SHOW CHANGES MADE

(Amended) A method of [fabricating a crystalline semiconductor thin film,] manufacturing a semiconductor device comprising the steps of:

[adding a catalytic element for facilitating crystallization of an amorphous semiconductor thin film to the amorphous semiconductor thin film;

carrying out a first heat treatment to transform the amorphous semiconductor thin film into a crystalline semiconductor thin film by irradiating an ultraviolet light or an infrared light; and

carrying out a second heat treatment for the crystalline semiconductor thin film at 900 to 1200 °C in a reducing atmosphere.]

forming a semiconductor film comprising silicon over a substrate;

providing said semiconductor film with a catalytic element for facilitating a crystallization of said semiconductor film;

irradiating said semiconductor film with laser light in air for crystallizing said semiconductor film after providing said catalytic element;

removing an oxide film from a surface of said semiconductor film by etching after said irradiation of said laser light; and

leveling said surface of said semiconductor film by heating after removing said oxide film.

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